



Strategies to Better Facilitate Understanding of Hydrogeology, Contaminant Fate & Transport, and Potential Remedial Alternatives at Petroleum Sites

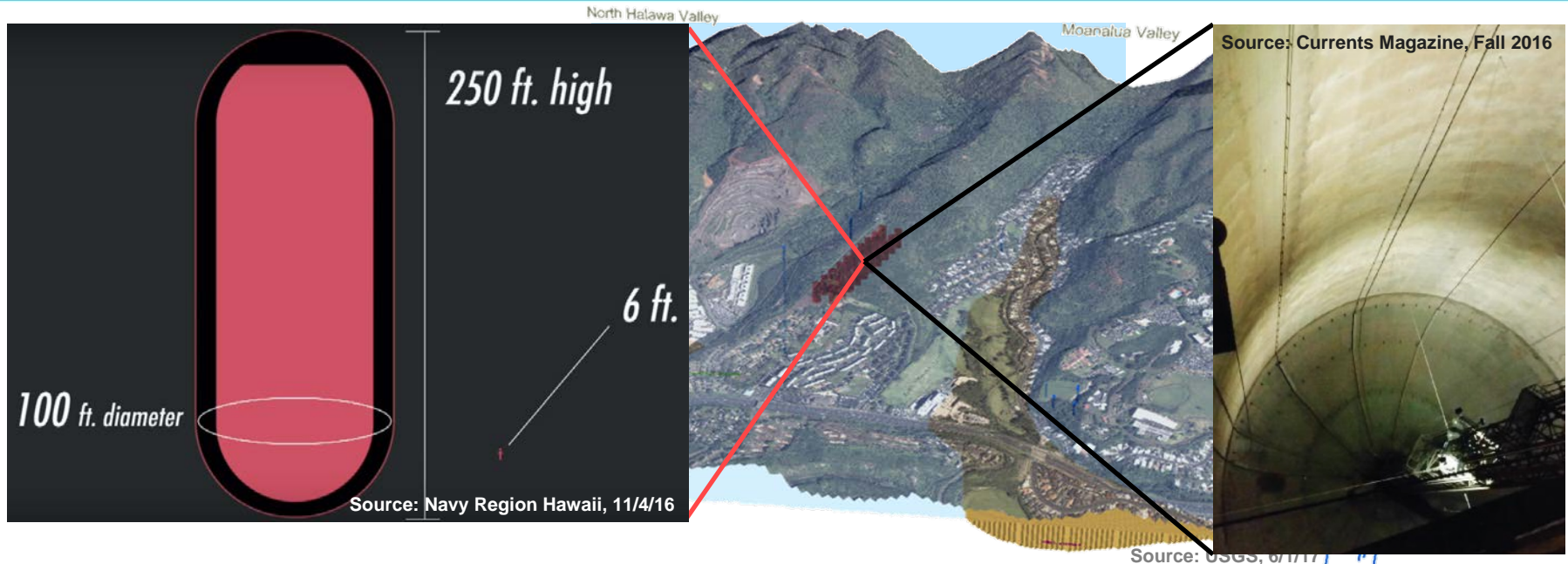
Presented By
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Present some strategies being used to better facilitate understanding of the conceptual site model and other key technical concepts for various audience types

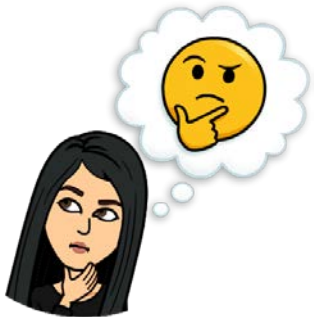
- Site Overview
- Challenges in the Facilitation and Improvement of Understanding
 - Audience types
 - Key technical concepts for the audience to understand (and why this matters)
- Strategies to Better Communicate/Facilitate Technical Concepts
 - Contexts and goals (i.e. what is being communicated and why)
 - Key strategies: working groups and visualizations
- Summary and Questions

Site Overview



- Constructed in the 1940s, the Red Hill Bulk Fuel Storage Facility currently contains 18 active and 2 inactive tanks each with an estimated capacity of 12.5 million gallons currently holding JP-5, F-24, and marine diesel fuels
- Two environmental investigations currently in-progress at Red Hill:
 - Red Hill Oily Waste Disposal Facility (ERN site)
 - Red Hill Bulk Fuel Storage Facility

Challenges



1. Complex site with high interest/visibility/scrutiny and national security asset
2. Various audience types
3. Need the audience to understand key technical concepts
4. Understanding is critical to resolution, so how do we better facilitate this?

- **Complex Site and Technical Defensibility**

- Requires integration of multiple remedial approaches, risk management strategies including contingency plans, and continued long-term monitoring

- **Three General Audience Types**

- Regulatory agencies, various stakeholders with their own subject-matter-experts, and the public

- **Key Technical Concepts**

- Conceptual site model, groundwater models, and remedial alternatives

- **What Are Some Effective Strategies to Better Facilitate Communication of Complex Technical Information for Reaching Optimal Resolutions?**

❖ **Goal: Build Trust and Transparency, and Demonstrate Technical Capabilities**

• **Strategies Being Used: Working Groups and Visualizations**

- Focused working groups allow for real-time technical feedback from stakeholders on decision-tool development such as the groundwater flow model
- 3-D visualizations of the conceptual site model, groundwater flow model domain, animation used to depict key technical concepts such as mass flux

• **Strategy Context Governed by Target Audience**

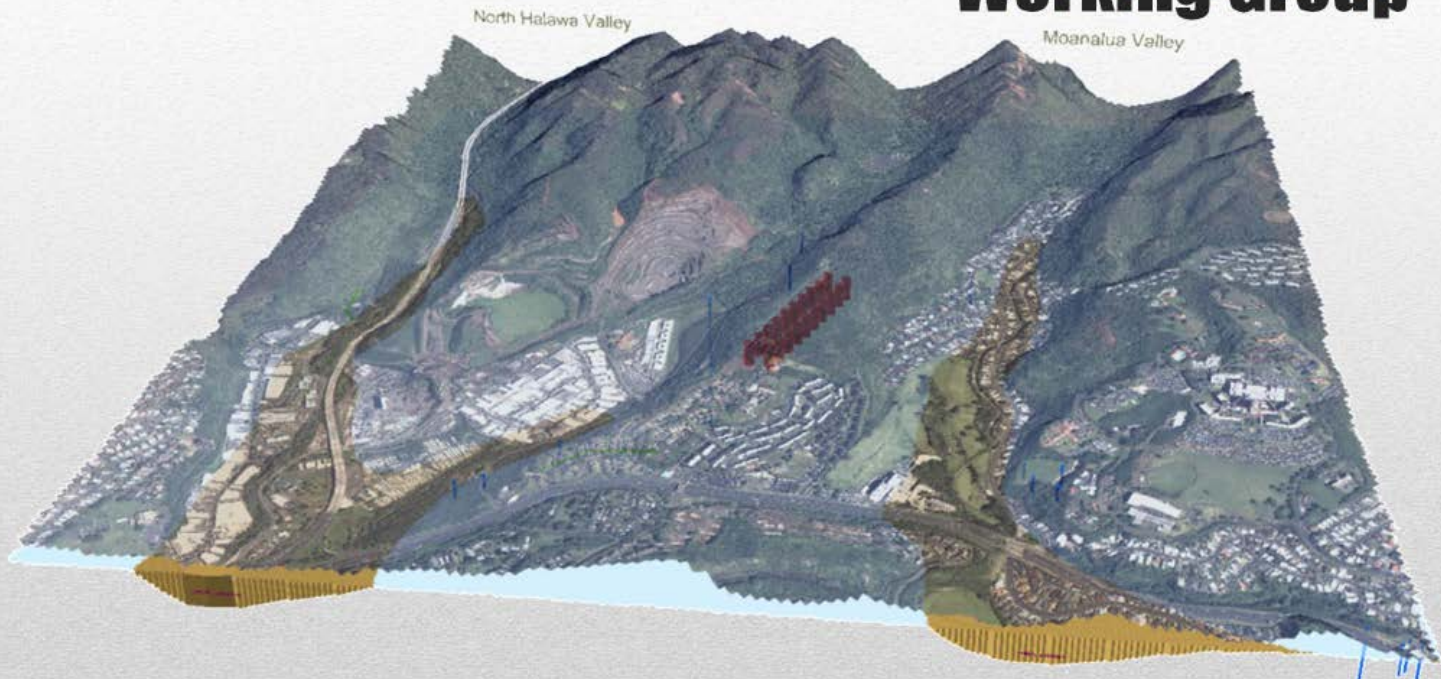
Site-Specific Examples:

- What is the conceptual site model and what does the site geology consist of?
- What is the direction of groundwater flow within and around the Red Hill area?
- Are there geologic barriers to groundwater flow and contaminant transport?
- How are the different stratigraphic sections of the groundwater flow model situated?
- How is the Navy reducing risk to drinking water?

Working Group Example



Red Hill Groundwater-Modeling Working Group



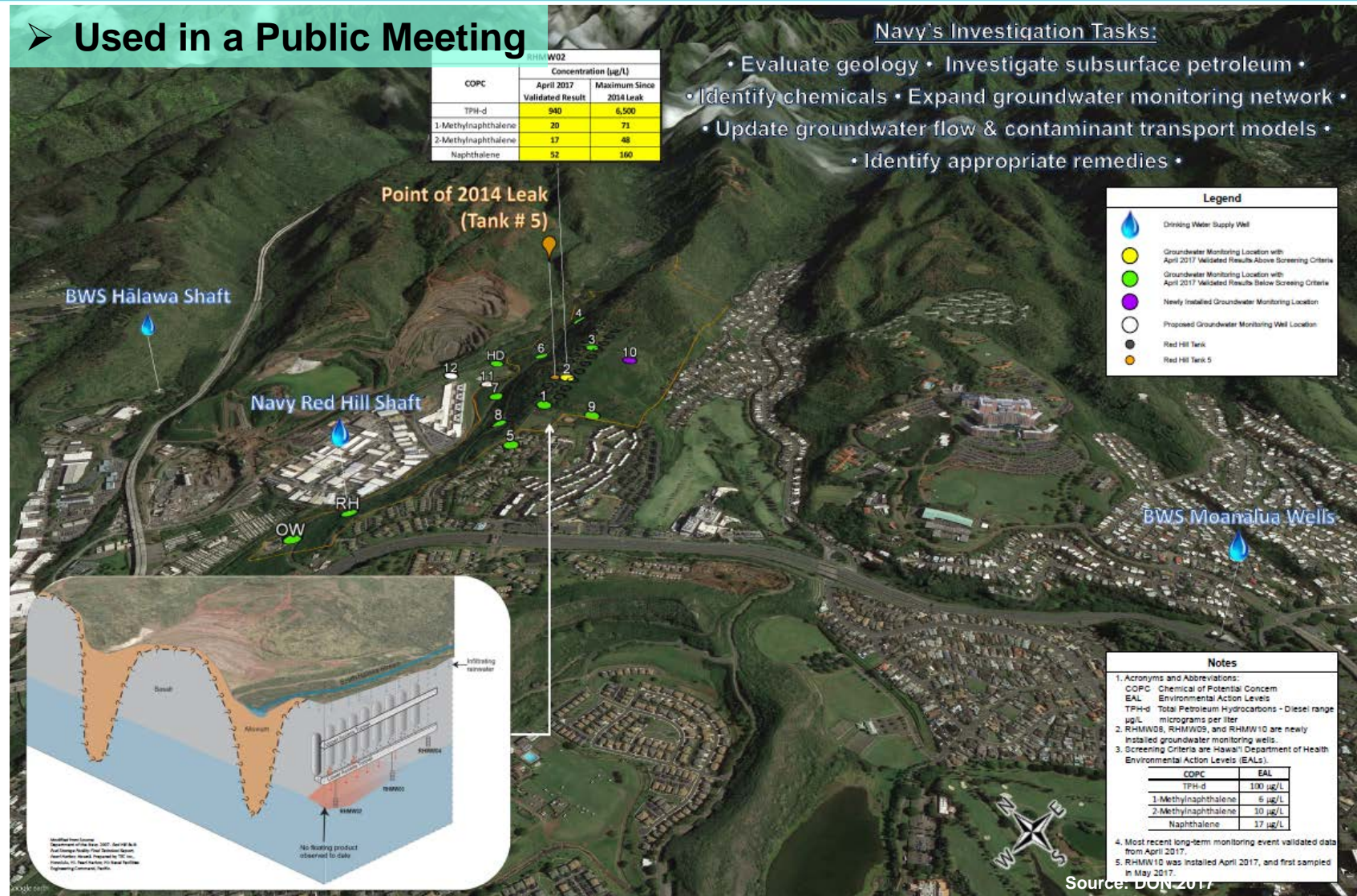
U.S. Department of the Interior
U.S. Geological Survey

Initial Meeting
June 1, 2017, 9:30 to 11:30am
Inouye Regional Center, Ford Island

Study Area and Focus



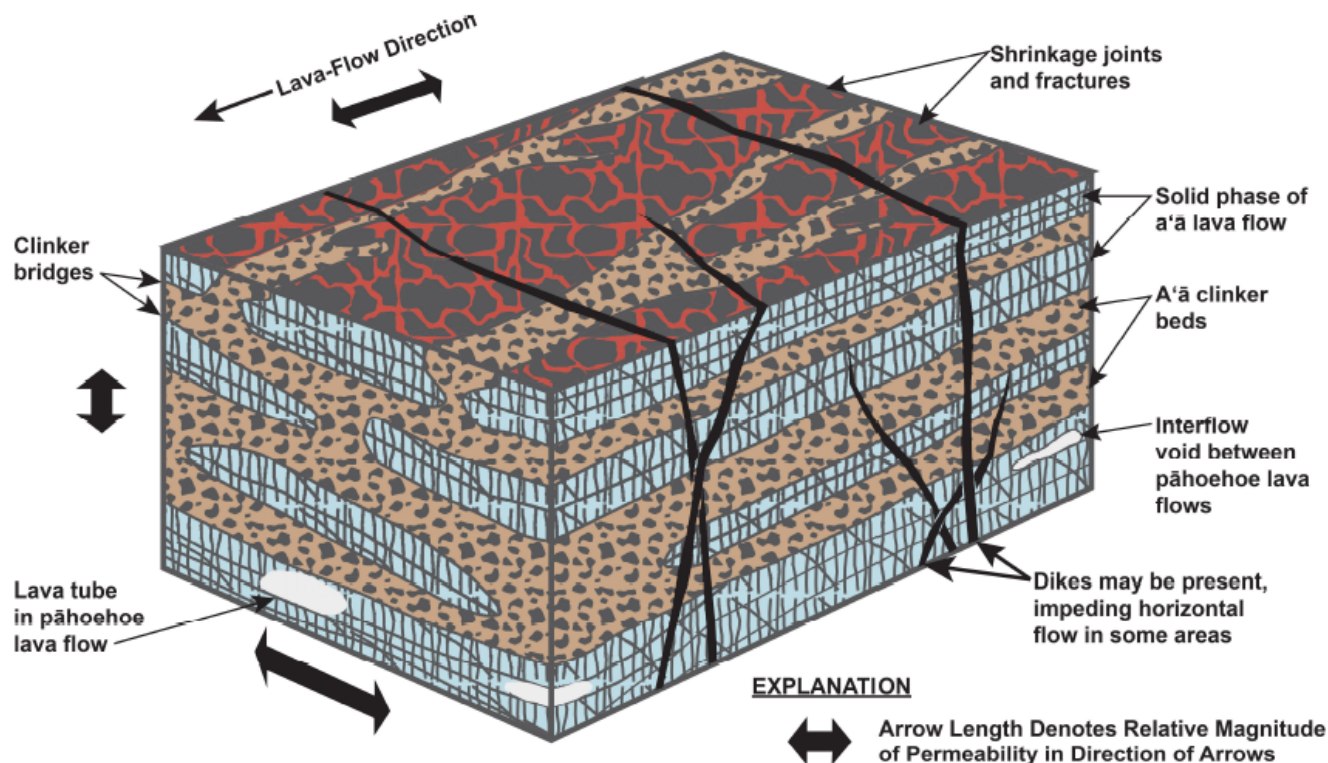
➤ Used in a Public Meeting



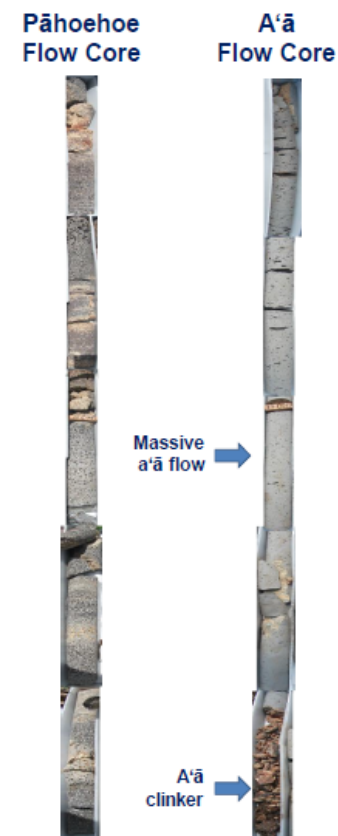
Complex Subsurface Geology at Red Hill

The Navy/DLA are collecting geologic data to better understand and evaluate groundwater flow and potential chemical movement beneath the tanks and nearby areas.

➤ Used in Technical Discussions and a Public Meeting



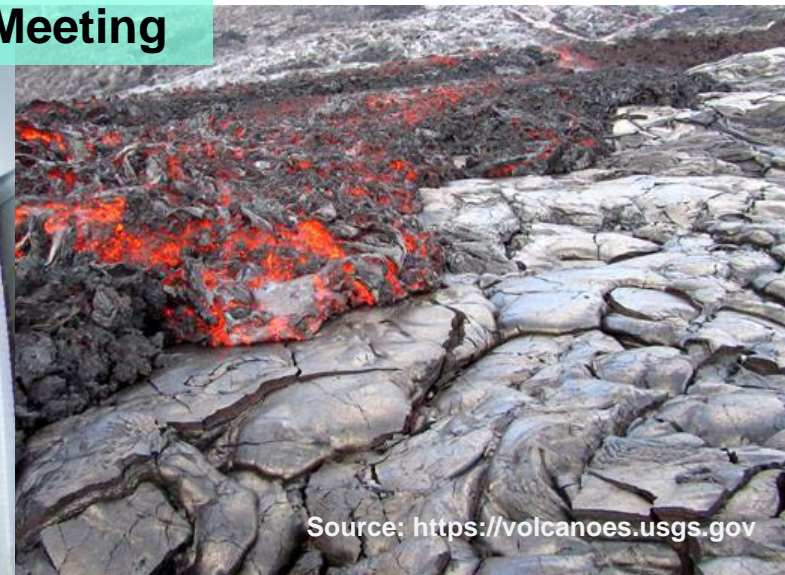
Source: modified from *Water in the Kahuku Area, Oahu, Hawaii*, 1969, Geological Survey Water-Supply Paper 1874, by K. J. Takasaki and S. Valenciano.



Geology (Cont.)



➤ Used in Technical Discussions and a Public Meeting





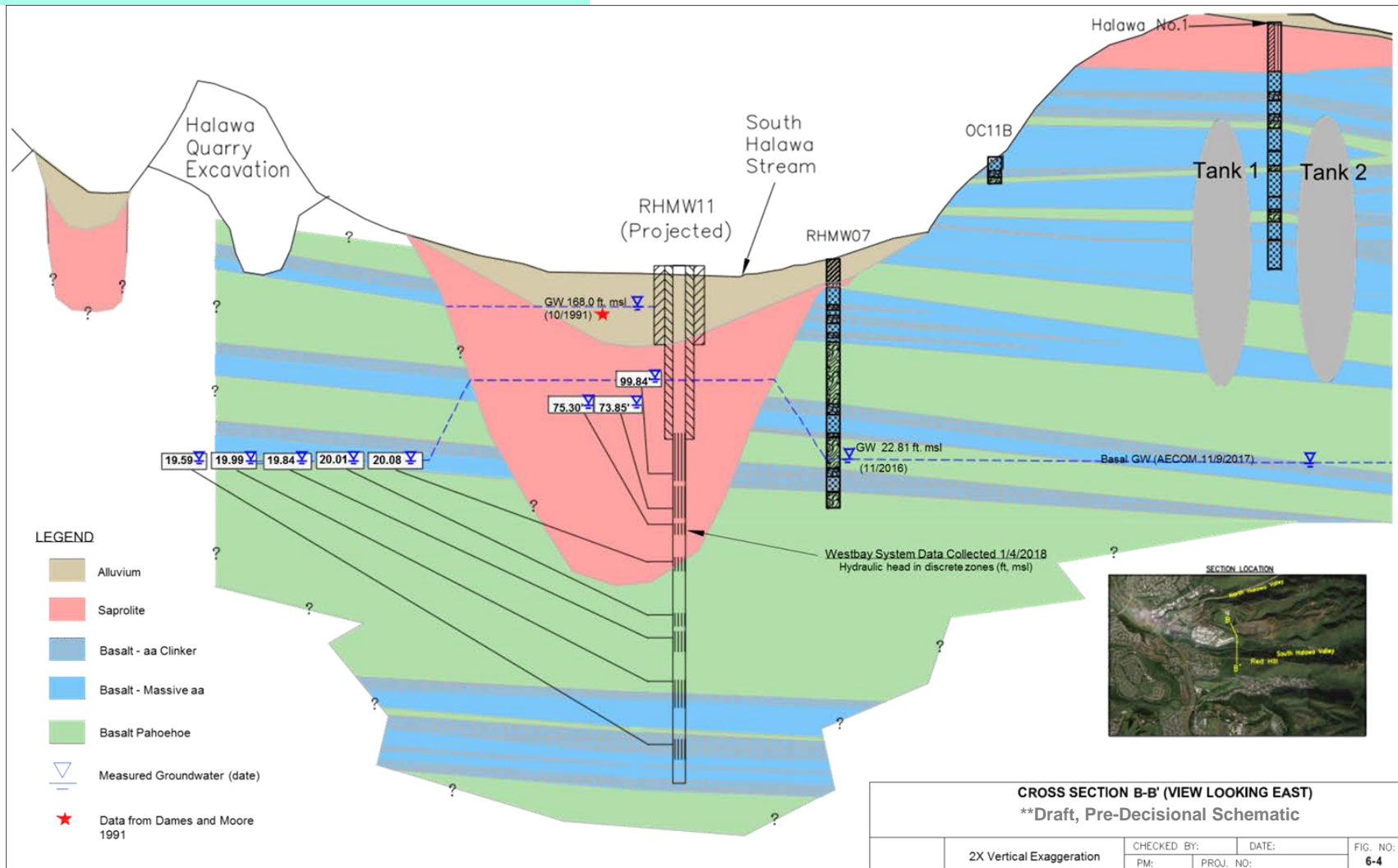
- ## KEY PLAN



Geologic Cross Sections

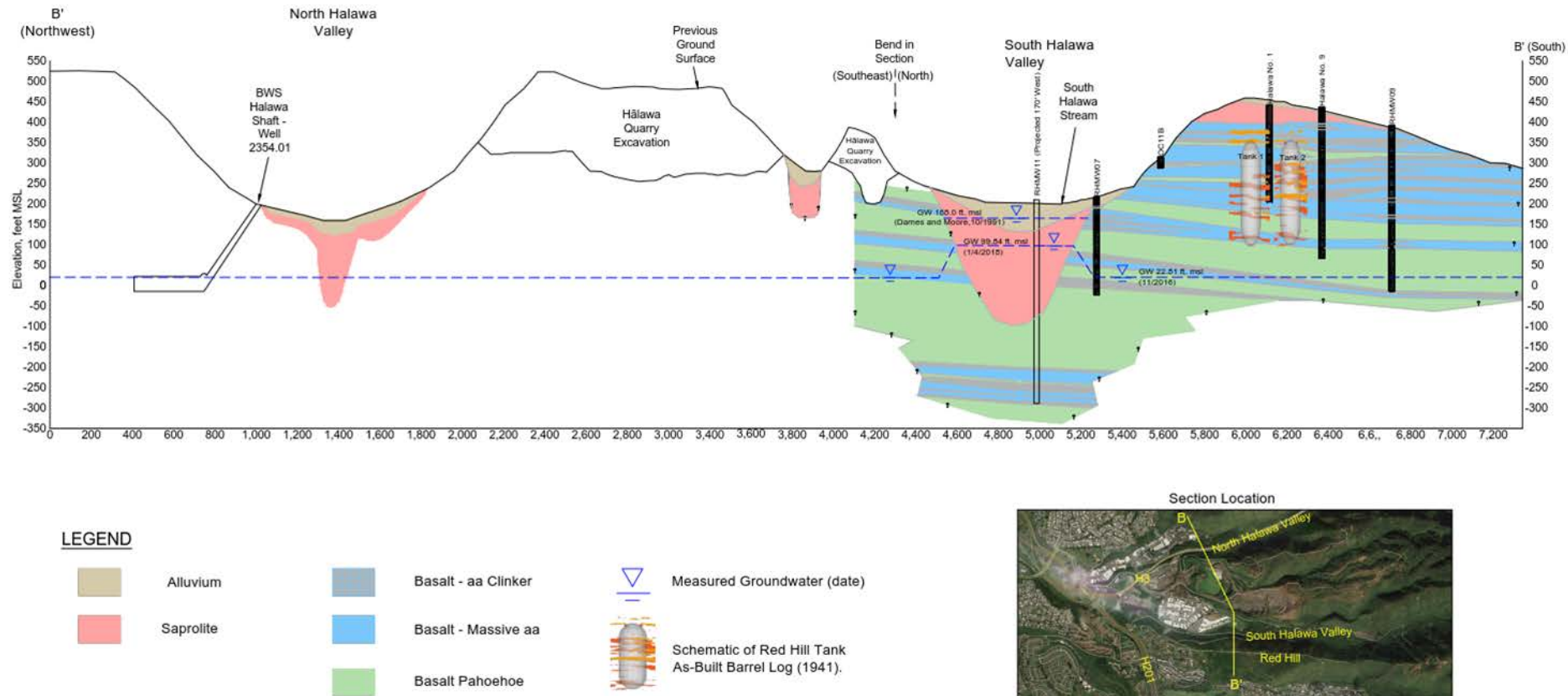


➤ Used in Technical Discussions



Geologic Cross Sections (Cont.)

➤ Used in Technical Discussions



Geologic CSM: Seismic Data



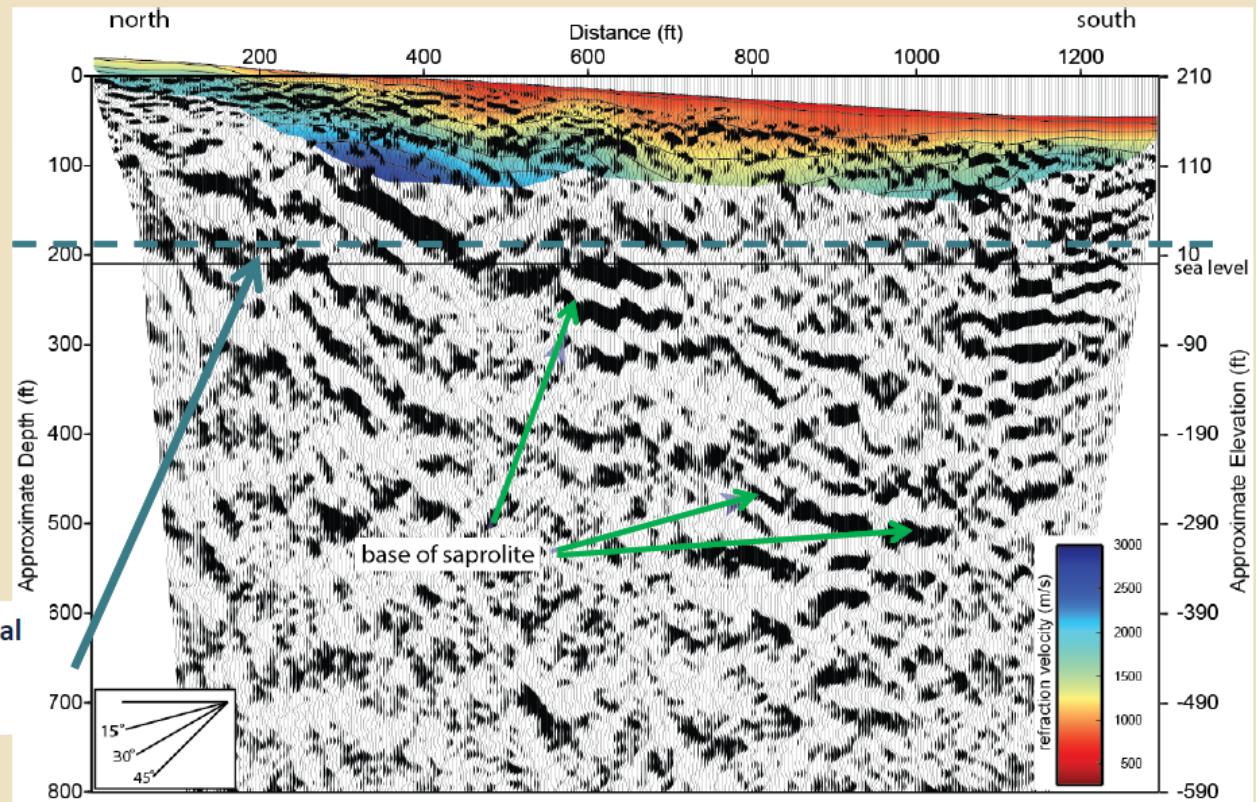
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- Base of saprolite extends to approximately -290 ft msl

Approximate Local
Groundwater
Elevation

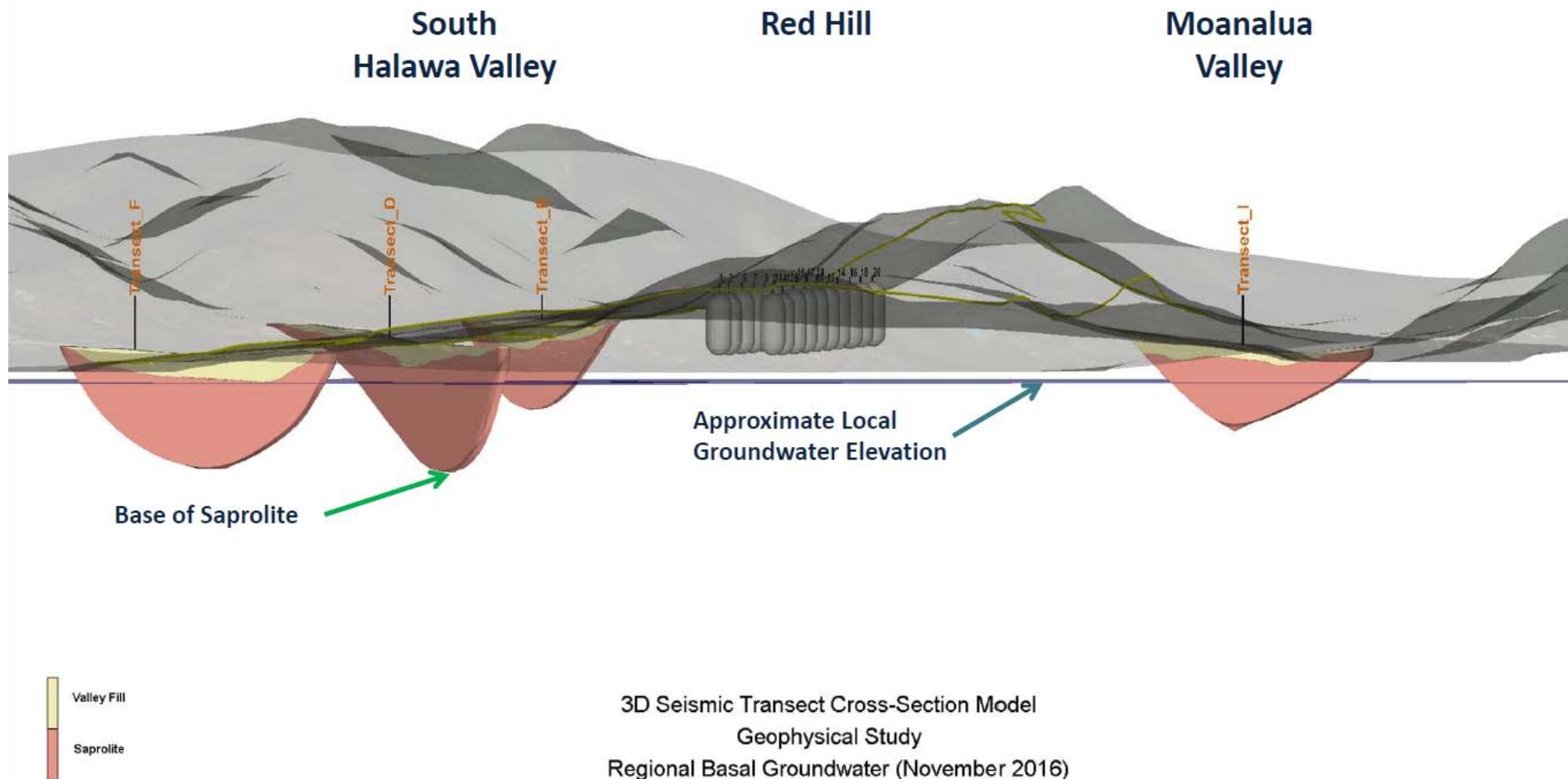
Seismic Refraction & Reflection Composite Image



Geologic CSM: Seismic Data (Cont.)



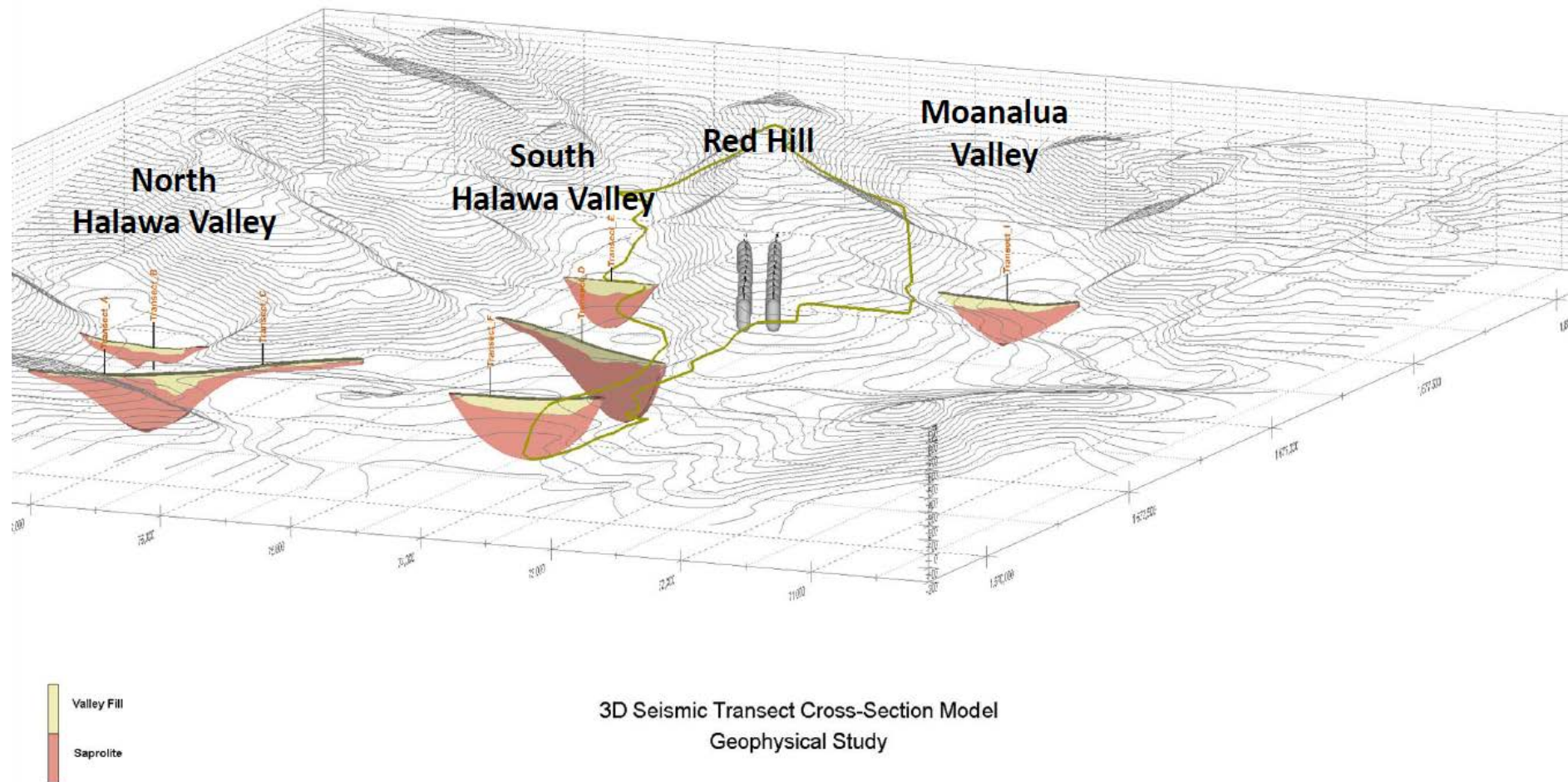
➤ Used in Technical Discussions



Geologic CSM: Seismic Data (Cont.)



➤ Used in Technical Discussions



Groundwater Model Concepts

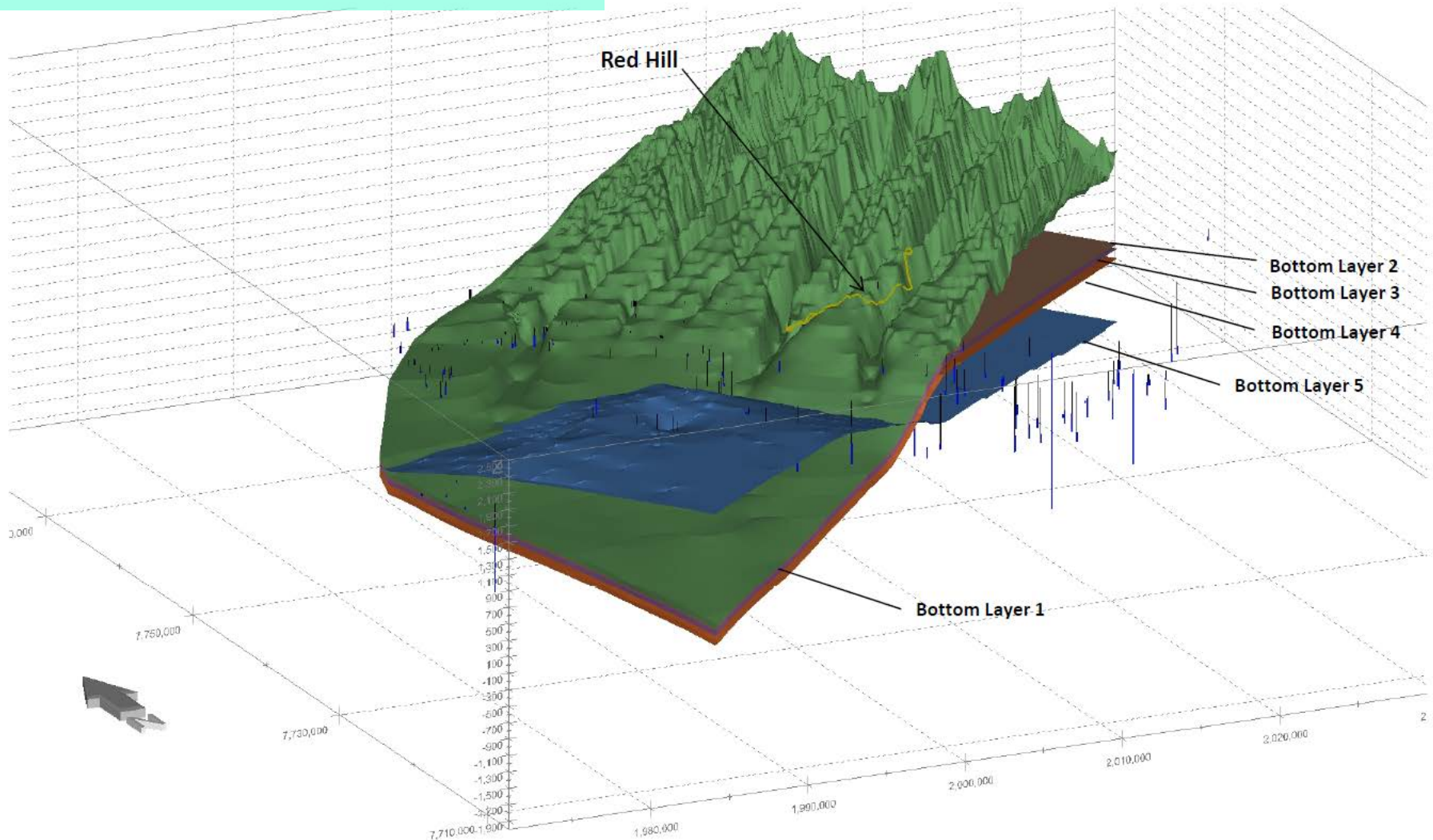


- **Comprehensive 3-D evaluation and documentation of subsurface geologic conditions that influence flow, fate, and transport is a priority...**
 - ...in the development of the Red Hill CSM to support predictive modeling
 - ...for evaluation of remedial alternatives and contingency planning
- **Strong caution is advised to ensure flow, fate, and transport are not over-simplified**
- **There is confidence in our models as they are representative of site conditions**

Groundwater Model Concepts (Cont.)



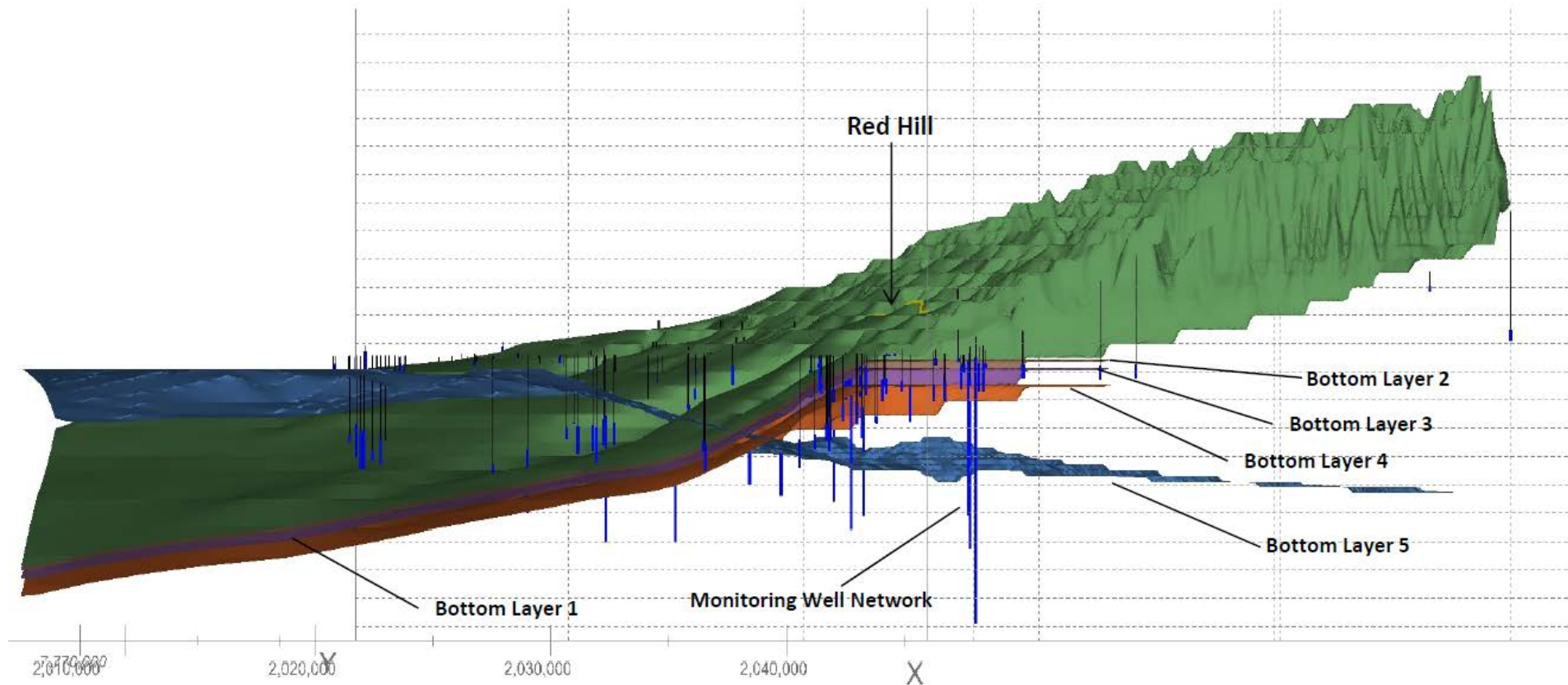
➤ Used in Technical Discussions



Groundwater Model Concepts (Cont.)



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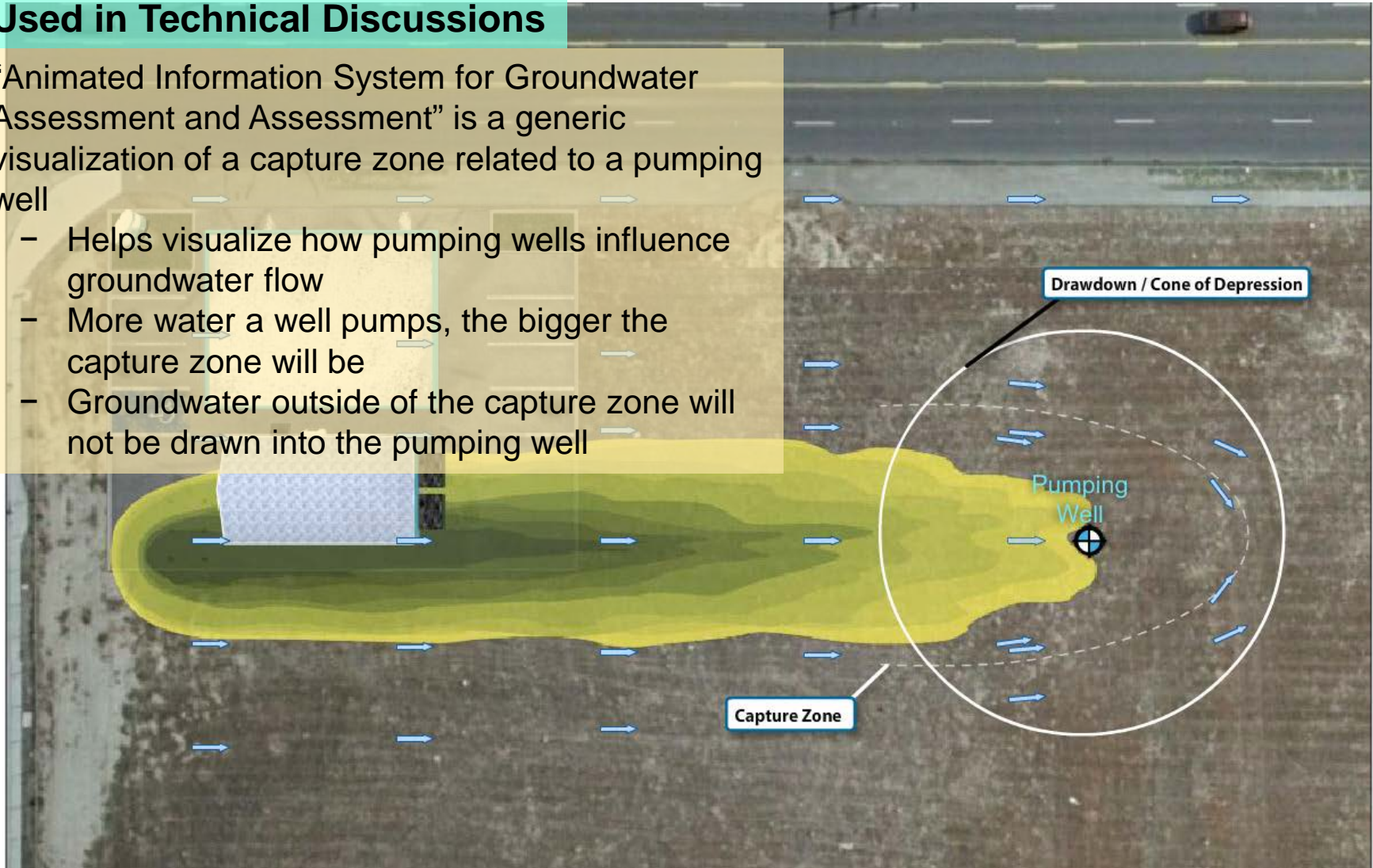


Remedial Alternative Considerations



➤ Used in Technical Discussions

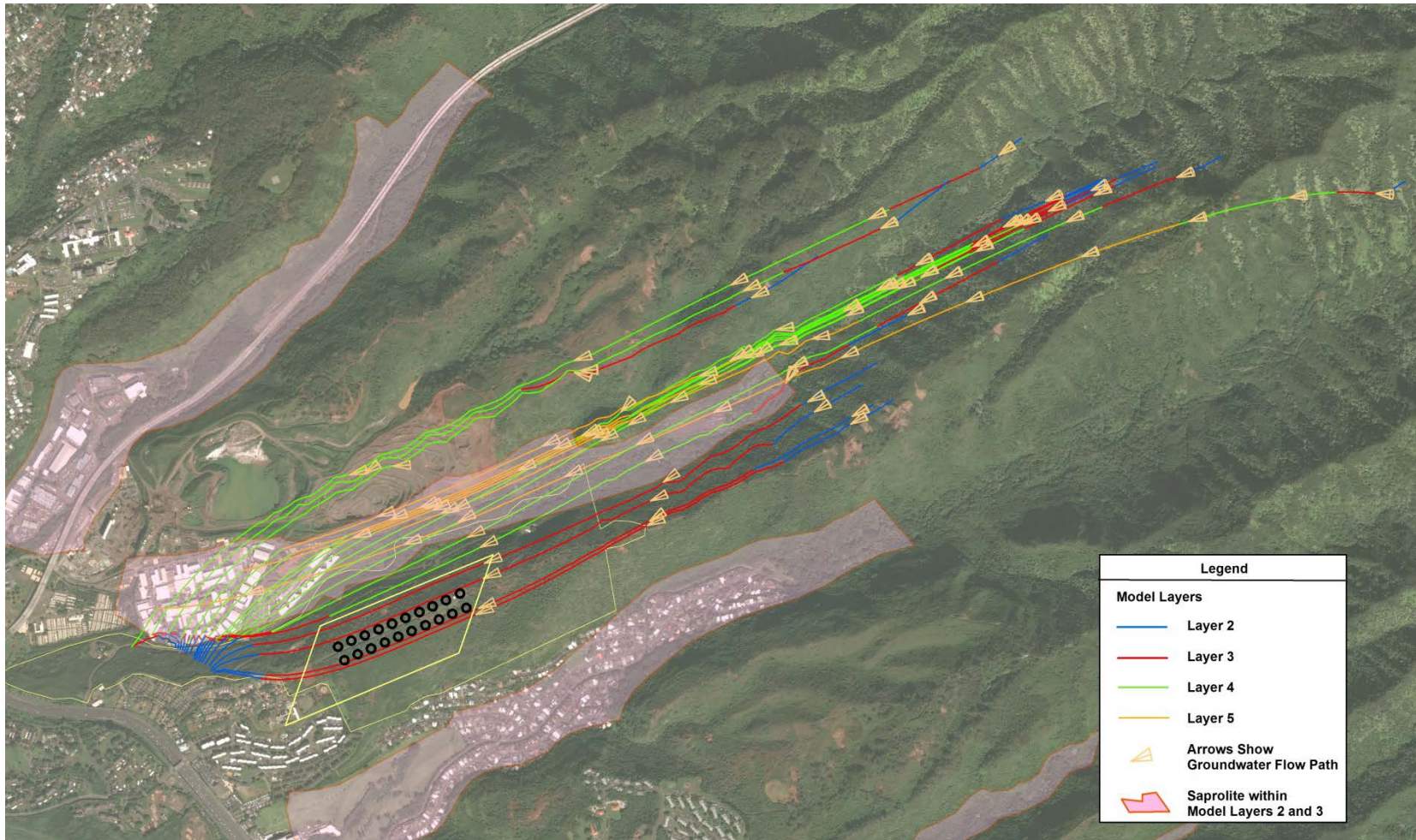
- “Animated Information System for Groundwater Assessment and Assessment” is a generic visualization of a capture zone related to a pumping well
 - Helps visualize how pumping wells influence groundwater flow
 - More water a well pumps, the bigger the capture zone will be
 - Groundwater outside of the capture zone will not be drawn into the pumping well



Remedial Alternatives: Capture Zone



➤ Used in Technical Discussions and Planned for Upcoming Public Meeting

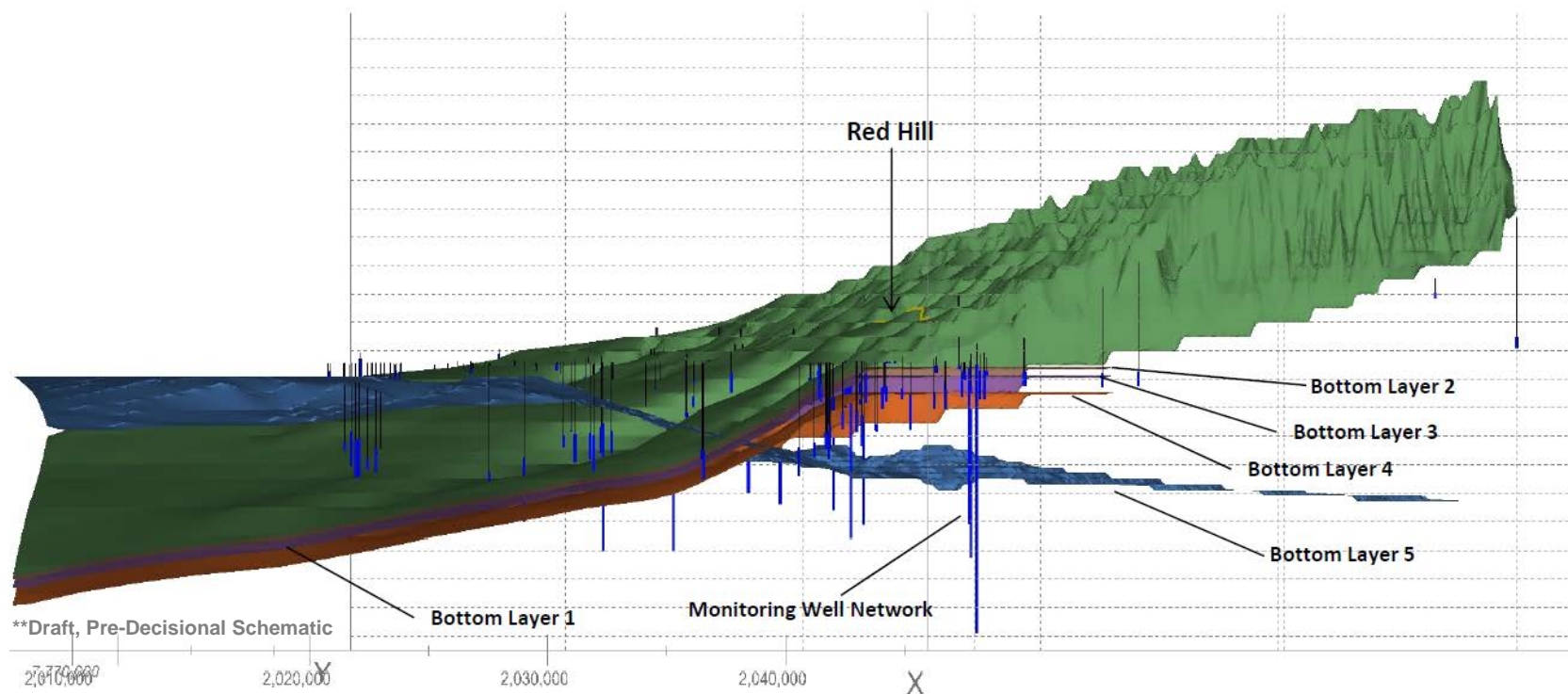


Summary



- A comprehensive 3-D evaluation and documentation of subsurface geologic conditions that influence flow, fate, and transport are priorities...
 - ...in the development of the Red Hill CSM to support predictive modeling tools used to evaluate and make decisions regarding remedial alternatives and contingency plans
 - ...to better facilitate understanding of the conceptual site model and key technical concepts for various audience types
- 3-D visuals presented were created utilizing the Environmental Visualization System (EVS) by C Tech, and the generic visualization of a capture zone utilized the “Animated Information System for Groundwater Assessment and Assessment”
- A phenomenal technical team is key!

Questions and Contact



Point of Contact

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